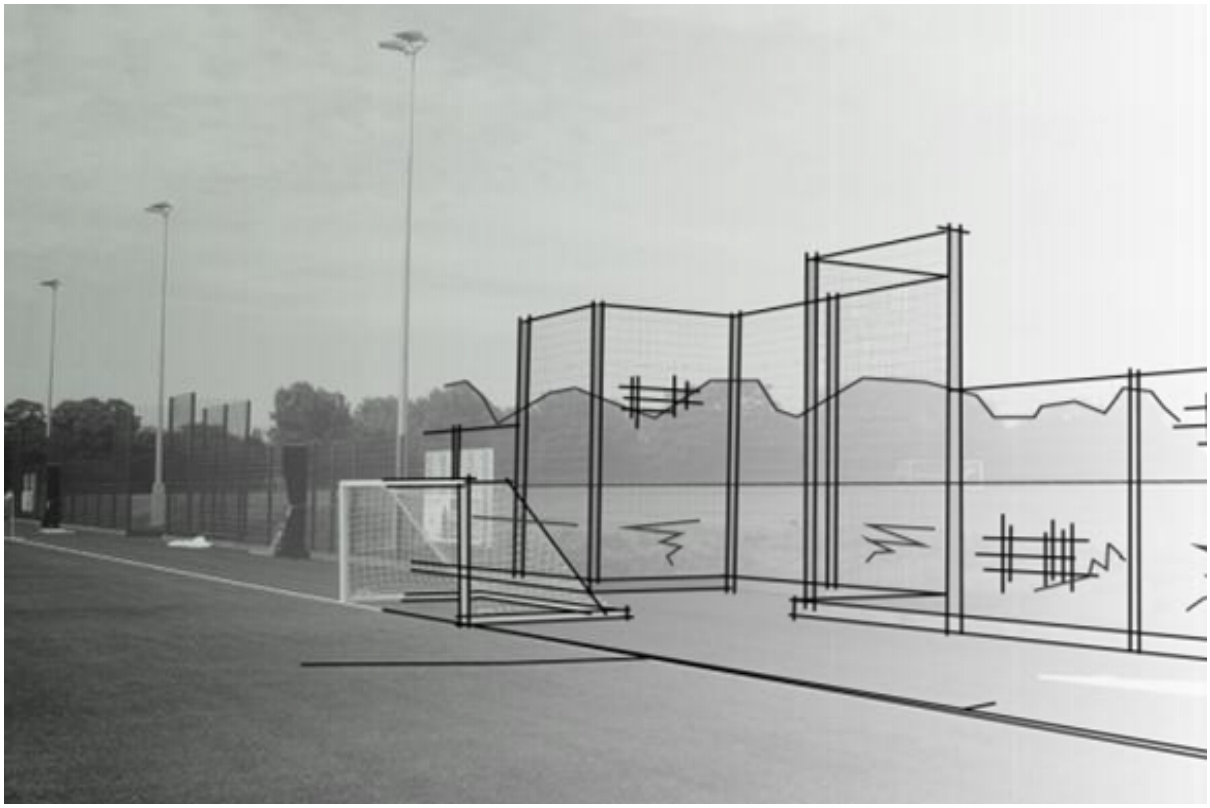
Wythenshawe Sports Ground

Creation of 4Nr. 3G Artificial Grass Pitches (AGPs) with perimeter fencing, hardstanding areas, 18Nr. floodlights, a maintenance storage container and a 20ft F&B Container

Flood Risk Assessment



Site	Wythenshawe Sports Ground Willenhall Rd, Manchester M23 0BD		
Project	Creation of 4Nr. 3G Artificial Grass Pitches (AGPs) with perimeter fencing, hardstanding areas, 18Nr. floodlights, a maintenance storage container and a 20ft F&B Container		
SSL project code	G-229824		
Document title	Flood Risk Assessment		
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Site Context

Site Location

The proposed development site comprises a large playing field located off Willenhall Road. The scheme proposes the construction of four artificial pitches within this field. The wider sports complex contains four additional surrounding playing field segments which serve both football and softball/baseball.

To the north lies an additional football field, beyond which are a topsoil supplier, an electrical substation, and a golf course, with the River Mersey running east–west just north of the substation. To the east is the largest field within the complex, with Kenworthy Woods located just beyond the site boundary. To the south the site is bordered by the M60 motorway, beyond which lies the large residential areas of Northern Moor and Wythenshawe Park and Gardens. To the west the site, beyond the M60, is bordered by residential properties and the B5166.



Figure 1 - Site Location

Site History

Historically, the site comprised agricultural land with very limited surrounding development. By 1848, the area was largely rural, with Fairylane Farm located to the west of the proposed development site, part of which now forms part of the current sports hub. Between 1945 and 1965, mapping shows a footpath running east–west along the southern edge of the site, while the farm appears to have been renamed Oak Farm, with only limited settlement to the north. By 2000, the character of the site had changed, with buildings constructed to the south, the introduction of a motorway immediately south of the site, and the fields appearing to have transitioned to sporting use. By 2009, the site had become an established sports facility and by 2022 the layout and use of the site had remained largely unchanged, with little additional development recorded.

Site Topography

The topography over the pitch area shows a fall from the east to the west by approximately 1.2m. Further information on existing levels can be seen within 'G-229824 01 - Existing Site Plan'.

Existing Drainage

There is no existing formal land drainage across the site.

Local Watercourses

There is a watercourse to the west of the facility. The existing ground currently directs surface water towards the watercourse and therefore surface water currently enters this watercourse without any control or restriction. The proposal is to connect into the existing watercourse with a restricted outfall to improve the existing arrangement. Figure 2 below is taken from the Environment Agency's (EA) Statutory Main River Map showing the watercourse to the west of the site.



Figure 2 – Existing Watercourse to the West of the Playing Field (source: EA)

Ground Conditions

Ground conditions comprised Topsoil to a maximum depth of 0.40mbgl. The topsoil was generally immediately underlain by medium dense to dense brown slightly gravelly sand/light greyish brown gravelly sand.

Groundwater

Groundwater was encountered in some boreholes at depths of between 1.00m and 2.00mbgl. This is considered to be representative of a shallow groundwater table beneath the site. Groundwater levels are expected to vary seasonally and in response to weather events.

Infiltration Potential

BRE365 soakaway testing targeted at the shallow natural granular deposits was undertaken in SA01. This was positioned in an area designated as potentially suitable for infiltration. In summary, slow infiltration was recorded within the natural deposits and this is considered to be due to the presence of the shallow groundwater beneath the site. Therefore soakaway drainage is not considered to be suitable for the site and it is recommended that alternative drainage strategies are sought.

Source Protection Zone

The site is **not** located within a Source Protection Zone.

Coal Mining

Coal Authority mapping data shows the site **does not** lie within a Coal Mining Reporting area.

Flood Risk

The Government websites confirm the proposed development area is located within a flood zone 1.

Flood zone 1 - This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%). The likelihood of flooding from the rivers or the sea at the proposed development site is very low.



Figure 3 - Flood Map for Planning

Risk of Flooding from Rivers and Sea

The Government website confirms the proposed development area is at no risk of flooding from rivers or sea, which happens when there are high tides and stormy conditions.

Risk of Flooding from Surface Water

The Government website confirms the majority of the proposed development area is at very low risk of flooding from surface water, which happens when rainwater does not drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead.

Very low risk means that each year this area has a chance of flooding of less than 0.1%.

To the south of the site the surface water flood risk increases to medium (>1% and <3.3%) and high (>3.3%).

Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

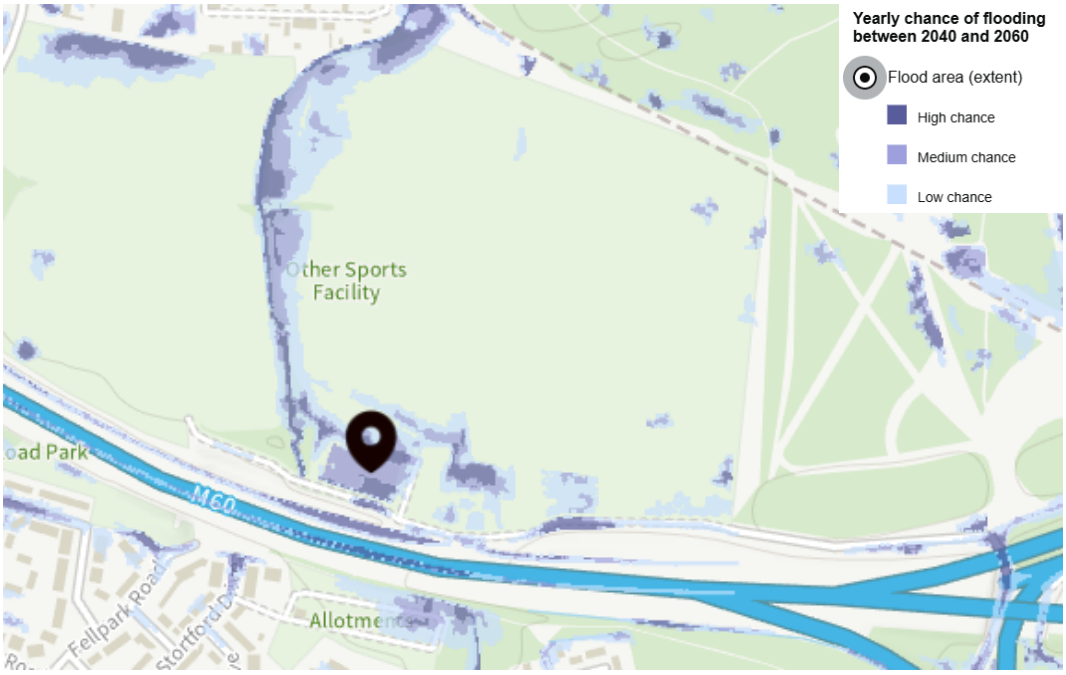


Figure 4 – Surface Water Flood Map

Development Proposals and Flood Risk Vulnerability

Whilst the proposal is situated within a Flood Zone 1, the development site is larger than 1ha and therefore a comparison of the proposal against flood risk vulnerability classifications is required.

Planning Policy Framework

NPPF - Meeting the Challenge of Climate Change, Flooding and Coastal Change

Paragraph 181 sets out:

When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

(a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
(b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;
(c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
(d) any residual risk can be safely managed; and
(e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

DEFRA - National standards for sustainable drainage systems (SuDS)

The surface water drainage scheme must be in accordance with the National standards for sustainable drainage systems (SuDS) (June 2025) or any subsequent replacement national standards and unless otherwise agreed in writing by the Local Planning Authority, no surface water shall discharge to the public sewerage system either directly or indirectly.

Flood Risk Vulnerability Classification

To assist the application for full planning permission and to facilitate the satisfactory implementation and delivery of the project; an assessment of flood risk and a sustainable drainage proposal is required in accordance with national policies.

With reference to Annex 3 within the 2024 National Planning Policy Framework, the proposed development for an outdoor sports facility would be classified as Water Compatible Development.

Water-Compatible Development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence installations.

- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- **Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.**
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan

Based on the above assessment of the site being located within a Flood Zone 1 and classified as a 'water compatible development' and with reference to Planning Practice Guidance for 'Flood Risk and Coastal Change' to the National Planning Policy Framework (Table 3), the proposed development of this site would be considered "appropriate".

Table 1 - Flood Risk Vulnerability and Flood Zone Compatibility

Flood risk vulnerability classification	Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3A	Exception Test required	✓	×	Exception Test required	✓
Zone 3B	Exception Test required	✓	×	×	×

Key:
✓Development is appropriate
×Development should not be permitted

Sequential Test

As the site is located within a Flood Zone 1 and is water compatible, a sequential test is not required and it is worth noting the site is used (and historically designated) as a sports complex (active playing field) the development can be deemed to have passed the sequential test.

The proposed development will replace part of an existing playing field.

Surface Water Disposal Hierarchy

In accordance with the National Planning Policy Framework (NPPF) and the National Planning Practice Guidance (NPPG), the site should be drained in the most sustainable way. No foul sewage will be created as part of this development.

The National standards for sustainable drainage systems (SuDS) (2025) clearly outlines the hierarchy to be investigated by the developer when considering a surface water drainage strategy. As such, the developer must consider the following drainage options in the following order of priority:

A. Collected for non-potable use;
B. Infiltrated to ground;
C. Discharged to an above ground surface water body;
D. To a surface water sewer, highway drain, or another piped drainage system;
E. Discharged to a combined sewer.

This is necessary to promote sustainable development, secure proper drainage and to manage the risk of flooding and pollution. This condition is imposed considering policies within the NPPF and NPPG.

Overland Flow Risk and Compensation Measures

Flood compensation measures will not be required as finished (floor) levels will not affect current flood plain storage onsite.

There is a risk of the critical storm event being exceeded, albeit this risk is considered very low.

In such an event the proposed drainage systems will become overwhelmed and overland flows could occur.

Surface Water Drainage Strategy

Surface Water Disposal Options

The National standards for sustainable drainage systems (SuDS) (2025) clearly outlines the hierarchy to be investigated by the developer when considering a surface water drainage strategy. As such, the drainage options have been considered and followed in the following order of priority:

A. Collected for non-potable use

At the AGP site there is no significant or continuous on-site water demand and therefore there is no scope for the reuse of surface water within the site, and so rainwater re-use is not proposed.

B. Soak away

The soils across the pitch are not considered amenable to the use of soakaway type systems, thus an alternative drainage solution will need to be considered.

C. Surface Water Body

There is a watercourse to the west of the development site. the proposal is to connect into the existing drainage network to outfall into the watercourse to the west.

D. Surface Water Sewer

Not required due to Option C being possible.

E. Combined Sewer

Not required due to Option C being possible.

Surface Water Drainage Principle

FIFA's Quality Concept for Football Turf (Handbook of Requirements January 2015 Edition) requires 3G artificial grass to provide water permeability (for outdoor uses) >180mm/hr and advises that to ensure adequate drainage of a field, all individual elements of the football turf should satisfy this requirement.

A network of Hydraway strip drains will collect and convey runoff to perimeter drainage channels, which direct surface water to a final outfall chamber with a restricted discharge.

The granular pitch substrate (typically consisting of Type 3 unbound (SHW 800 Series) to comply with BSEN 13285) is intended to provide onsite containment and attenuation within the granular sub-base, before surface water enters the proposed surface water connection.

The designed surface water drainage solution should be based upon the following criteria, to maintain satisfactory system performance:

- Provide adequate functionality over a period of twenty years.
- Prevent the risk of uncontrolled flooding elsewhere (to land adjacent to the development).

- Comply with all applicable Sustainable Urban Drainage System (SUDS) requirements with attenuated flows (containment within the granular pitch sub-base) incorporated wherever necessary, without affecting the performance of the pitch.

This is achieved through the surface water being attenuated / stored within the construction make up of the artificial turf pitch that has 37% void space acting as the surface water drainage.

As shown below the calculated volume for storage to meet a 1 in 100 year storm event + 45% climate change is 2090m3. The attenuation calculated within the base of the pitch allows the controlled storage onsite up to 2369m3 as detailed within G-229824 11 – Proposed AGP Drainage Strategy.

The proposed development and associated surface drainage strategy from this site is such that the surface water will be managed and disposed of within the existing surface water drainage, thus complying with the Technical Guidance to the National Planning Policy Framework.

Surface water management and disposal performance will be achieved by the following physical implications to the development (the Artificial Grass Pitches):

1. Adequate attenuation (water storage) within pitch bases (comprising a permeable granular sub-base) to ensure that excess volumes, which would be experienced during a critical storm event, does not bypass the control system;
2. Restricted flow rate to 5.7 l/s before discharging into the existing site drainage system and subsequently the adjacent watercourse, as calculated by the HR Wallingford method.

The drainage solution is designed to ensure no above ground flooding occurs up to and including the 1 in 100 year event plus a 45% allowance for climate change.

Drainage Calculations and Attenuation Capacity

Minimum Storage Required: 359 m^3

FACTOR	VALUE	SOURCE
Return Period (yrs):	2	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	5.7	Environment Agency, Water Authority, etc.
Contributing Area (ha):	2.5772	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	860	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	4	Volume 3 maps and site location
SOIL:	0.45	Soil Type and Volume 1, Section 7.4
UCWI:	94	SAAR and Volume 1, Figure 9.7
Calculated PR	80.81	
Percentage Runoff =	80.81	

FACTOR	VALUE
Additional Inflow (l/s):	0
Calculate/Specify PR:	Calculate
Specify PR:	100
Climate Change Allowance	0

Duration, D (min)	M2-D (mm)	incl climate change	Area C (ha)	PR (%)	Runoff (m3)	Add. Runoff (m3)	Total Runoff (m3)	Limiting Discharge (m3/min)	Limiting Runoff (m3)	Storage Required (m3)
15	7.4	7.4	2.58	81	154.1	0.0	154.1	0.34	5.1	149.0
30	9.5	9.5	2.58	81	197.9	0.0	197.9	0.34	10.3	187.6
60	11.9	11.9	2.58	81	247.8	0.0	247.8	0.34	20.5	227.3
120	15.9	15.9	2.58	81	331.1	0.0	331.1	0.34	41.0	290.1
240	20.3	20.3	2.58	81	423.2	0.0	423.2	0.34	82.1	341.1
360	23.1	23.1	2.58	81	481.1	0.0	481.1	0.34	123.1	358.0
480	25.1	25.1	2.58	81	523.6	0.0	523.6	0.34	164.2	359.4
600	26.8	26.8	2.58	81	557.5	0.0	557.5	0.34	205.2	352.3
720	28.1	28.1	2.58	81	586.1	0.0	586.1	0.34	246.2	339.8
840	29.3	29.3	2.58	81	610.9	0.0	610.9	0.34	287.3	323.6
1440	34.1	34.1	2.58	81	709.8	0.0	709.8	0.34	492.5	217.3
2160	38.4	38.4	2.58	81	800.0	0.0	800.0	0.34	738.7	61.2
2880	42.1	42.1	2.58	81	876.0	0.0	876.0	0.34	985.0	-109.0
3000	42.6	42.6	2.58	81	888.1	0.0	888.1	0.34	1026.0	-137.9
3300	44.1	44.1	2.58	81	917.8	0.0	917.8	0.34	1128.6	-210.8
3600	45.4	45.4	2.58	81	946.4	0.0	946.4	0.34	1231.2	-284.8
3900	46.8	46.8	2.58	81	974.3	0.0	974.3	0.34	1333.8	-359.5
4200	48.1	48.1	2.58	81	1001.6	0.0	1001.6	0.34	1436.4	-434.8
4500	49.4	49.4	2.58	81	1028.2	0.0	1028.2	0.34	1539.0	-510.8
4800	50.6	50.6	2.58	81	1054.3	0.0	1054.3	0.34	1641.6	-587.3

Figure 5 - 1 in 2 year attenuation volumes to 2.8 l/s

Minimum Storage Required: 906 m^3

FACTOR	VALUE	SOURCE
Return Period (yrs):	30	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	5.7	Environment Agency, Water Authority, etc.
Contributing Area (ha):	2.5772	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	860	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	4	Volume 3 maps and site location
SOIL:	0.45	Soil Type and Volume 1, Section 7.4
UCWI:	94	SAAR and Volume 1, Figure 9.7
Calculated PR	80.81	
Percentage Runoff =	80.81	

FACTOR	VALUE
Additional Inflow (l/s):	0
Calculate/Specify PR:	Calculate
Specify PR:	100
Climate Change Allowance	0

Duration, D (min)	M30-D (mm)	incl climate change	Area C (ha)	PR (%)	Runoff (m3)	Add. Runoff (m3)	Total Runoff (m3)	Limiting Discharge (m3/min)	Limiting Runoff (m3)	Storage Required (m3)
15	18.7	18.7	2.58	81	389.9	0.0	389.9	0.34	5.1	384.8
30	24.5	24.5	2.58	81	510.5	0.0	510.5	0.34	10.3	500.2
60	30.7	30.7	2.58	81	639.6	0.0	639.6	0.34	20.5	619.1
120	36.2	36.2	2.58	81	753.7	0.0	753.7	0.34	41.0	712.7
240	42.7	42.7	2.58	81	888.9	0.0	888.9	0.34	82.1	806.8
360	47.0	47.0	2.58	81	979.1	0.0	979.1	0.34	123.1	856.0
480	50.2	50.2	2.58	81	1045.5	0.0	1045.5	0.34	164.2	881.4
600	52.8	52.8	2.58	81	1100.5	0.0	1100.5	0.34	205.2	895.3
720	55.2	55.2	2.58	81	1148.6	0.0	1148.6	0.34	246.2	902.4
840	57.3	57.3	2.58	81	1193.0	0.0	1193.0	0.34	287.3	905.7
1440	65.7	65.7	2.58	81	1368.5	0.0	1368.5	0.34	492.5	876.1
2160	72.7	72.7	2.58	81	1513.9	0.0	1513.9	0.34	738.7	775.2
2880	78.0	78.0	2.58	81	1624.3	0.0	1624.3	0.34	985.0	639.3
3000	78.7	78.7	2.58	81	1639.9	0.0	1639.9	0.34	1026.0	613.9
3300	80.5	80.5	2.58	81	1677.2	0.0	1677.2	0.34	1128.6	548.6
3600	82.2	82.2	2.58	81	1712.2	0.0	1712.2	0.34	1231.2	481.0
3900	83.8	83.8	2.58	81	1745.1	0.0	1745.1	0.34	1333.8	411.3
4200	85.3	85.3	2.58	81	1776.5	0.0	1776.5	0.34	1436.4	340.1
4500	86.7	86.7	2.58	81	1806.5	0.0	1806.5	0.34	1539.0	267.5
4800	88.1	88.1	2.58	81	1835.3	0.0	1835.3	0.34	1641.6	193.7

Figure 6 - 1 in 30 year attenuation volumes to 2.8 l/s

Minimum Storage Required: 1355 m^3

FACTOR	VALUE	SOURCE	FACTOR	VALUE
Return Period (yrs):	30	Environment Agency, Water Authority, etc.	Additional Inflow (l/s):	0
Limiting Discharge (l/s):	5.7	Environment Agency, Water Authority, etc.	Calculate/Specify PR:	Calculate
Contributing Area (ha):	2.5772	Site plans	Specify PR:	100
Impervious, PIMP (%):	100	Site plans		
M5-60min (mm):	20	Volume 3 maps and site location	Climate Change Allowance	35
SAAR (mm/yr):	860	Volume 3 maps and site location		
Ratio, r:	0.4	Volume 3 maps and site location		
Soil Type:	4	Volume 3 maps and site location		
SOIL:	0.45	Soil Type and Volume 1, Section 7.4		
UCWI:	94	SAAR and Volume 1, Figure 9.7		
Calculated PR	80.81			
Percentage Runoff =	80.81			

Duration, D (min)	M30-D (mm)	incl climate change	Area C (ha)	PR (%)	Runoff (m3)	Add. Runoff (m3)	Total Runoff (m3)	Limiting Discharge (m3/min)	Limiting Runoff (m3)	Storage Required (m3)
15	18.7	25.3	2.58	81	526.3	0.0	526.3	0.34	5.1	521.2
30	24.5	33.1	2.58	81	689.1	0.0	689.1	0.34	10.3	678.9
60	30.7	41.5	2.58	81	863.5	0.0	863.5	0.34	20.5	842.9
120	36.2	48.9	2.58	81	1017.5	0.0	1017.5	0.34	41.0	976.5
240	42.7	57.6	2.58	81	1200.0	0.0	1200.0	0.34	82.1	1117.9
360	47.0	63.5	2.58	81	1321.8	0.0	1321.8	0.34	123.1	1198.6
480	50.2	67.8	2.58	81	1411.4	0.0	1411.4	0.34	164.2	1247.3
600	52.8	71.3	2.58	81	1485.7	0.0	1485.7	0.34	205.2	1280.5
720	55.2	74.5	2.58	81	1550.6	0.0	1550.6	0.34	246.2	1304.4
840	57.3	77.3	2.58	81	1610.5	0.0	1610.5	0.34	287.3	1323.2
1440	65.7	88.7	2.58	81	1847.5	0.0	1847.5	0.34	492.5	1355.0
2160	72.7	98.1	2.58	81	2043.8	0.0	2043.8	0.34	738.7	1305.1
2880	78.0	105.3	2.58	81	2192.8	0.0	2192.8	0.34	985.0	1207.8
3000	78.7	106.3	2.58	81	2213.9	0.0	2213.9	0.34	1026.0	1187.9
3300	80.5	108.7	2.58	81	2264.2	0.0	2264.2	0.34	1128.6	1135.6
3600	82.2	111.0	2.58	81	2311.4	0.0	2311.4	0.34	1231.2	1080.2
3900	83.8	113.1	2.58	81	2355.9	0.0	2355.9	0.34	1333.8	1022.1
4200	85.3	115.2	2.58	81	2398.3	0.0	2398.3	0.34	1436.4	961.9
4500	86.7	117.1	2.58	81	2438.8	0.0	2438.8	0.34	1539.0	899.8
4800	88.1	119.0	2.58	81	2477.6	0.0	2477.6	0.34	1641.6	836.0

Figure 7 - 1 in 30 year + 35% CC attenuation volumes to 2.8 l/s

Minimum Storage Required: 1275 m^3

FACTOR	VALUE	SOURCE	FACTOR	VALUE
Return Period (yrs):	100	Environment Agency, Water Authority, etc.	Additional Inflow (l/s):	0
Limiting Discharge (l/s):	5.7	Environment Agency, Water Authority, etc.	Calculate/Specify PR:	Calculate
Contributing Area (ha):	2.5772	Site plans	Specify PR:	100
Impervious, PIMP (%):	100	Site plans		
M5-60min (mm):	20	Volume 3 maps and site location	Climate Change Allowance	0
SAAR (mm/yr):	860	Volume 3 maps and site location		
Ratio, r:	0.4	Volume 3 maps and site location		
Soil Type:	4	Volume 3 maps and site location		
SOIL:	0.45	Soil Type and Volume 1, Section 7.4		
UCWI:	94	SAAR and Volume 1, Figure 9.7		
Calculated PR	80.81			
Percentage Runoff =	80.81			

Duration, D (min)	M100-D (mm)	incl climate change	Area C (ha)	PR (%)	Runoff (m3)	Add. Runoff (m3)	Total Runoff (m3)	Limiting Discharge (m3/min)	Limiting Runoff (m3)	Storage Required (m3)
15	23.7	23.7	2.58	81	494.4	0.0	494.4	0.34	5.1	489.3
30	31.3	31.3	2.58	81	652.3	0.0	652.3	0.34	10.3	642.0
60	39.6	39.6	2.58	81	824.3	0.0	824.3	0.34	20.5	803.8
120	45.9	45.9	2.58	81	956.8	0.0	956.8	0.34	41.0	915.7
240	53.8	53.8	2.58	81	1119.9	0.0	1119.9	0.34	82.1	1037.8
360	59.1	59.1	2.58	81	1231.1	0.0	1231.1	0.34	123.1	1108.0
480	63.5	63.5	2.58	81	1322.1	0.0	1322.1	0.34	164.2	1157.9
600	67.2	67.2	2.58	81	1399.8	0.0	1399.8	0.34	205.2	1194.6
720	70.5	70.5	2.58	81	1468.1	0.0	1468.1	0.34	246.2	1221.9
840	73.4	73.4	2.58	81	1529.5	0.0	1529.5	0.34	287.3	1242.3
1440	84.9	84.9	2.58	81	1767.2	0.0	1767.2	0.34	492.5	1274.7
2160	93.7	93.7	2.58	81	1951.1	0.0	1951.1	0.34	738.7	1212.3
2880	100.0	100.0	2.58	81	2082.1	0.0	2082.1	0.34	985.0	1097.1
3000	100.8	100.8	2.58	81	2100.2	0.0	2100.2	0.34	1026.0	1074.2
3300	102.9	102.9	2.58	81	2142.3	0.0	2142.3	0.34	1128.6	1013.7
3600	104.7	104.7	2.58	81	2181.4	0.0	2181.4	0.34	1231.2	950.2
3900	106.5	106.5	2.58	81	2217.7	0.0	2217.7	0.34	1333.8	883.9
4200	108.1	108.1	2.58	81	2251.6	0.0	2251.6	0.34	1436.4	815.2
4500	109.7	109.7	2.58	81	2283.9	0.0	2283.9	0.34	1539.0	744.9
4800	111.1	111.1	2.58	81	2314.3	0.0	2314.3	0.34	1641.6	672.7

Figure 8 - 1 in 100 year attenuation volumes to 2.8 l/s

Minimum Storage Required: **2090 m³**

FACTOR	VALUE	SOURCE
Return Period (yrs):	100	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	5.7	Environment Agency, Water Authority, etc.
Contributing Area (ha):	2.5772	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	860	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	4	Volume 3 maps and site location
SOIL:	0.45	Soil Type and Volume 1, Section 7.4
UCWI:	94	SAAR and Volume 1, Figure 9.7
Calculated PR	80.81	
Percentage Runoff =	80.81	

FACTOR	VALUE
Additional Inflow (l/s):	0
Calculate/Specify PR:	Calculate
Specify PR:	100
Climate Change Allowance	45

Duration, D (min)	M100-D (mm)	incl climate change	Area C (ha)	PR (%)	Runoff (m3)	Add. Runoff (m3)	Total Runoff (m3)	Limiting Discharge (m3/min)	Limiting Runoff (m3)	Storage Required (m3)
15	23.7	34.4	2.58	81	716.9	0.0	716.9	0.34	5.1	711.8
30	31.3	45.4	2.58	81	945.8	0.0	945.8	0.34	10.3	935.6
60	39.6	57.4	2.58	81	1195.3	0.0	1195.3	0.34	20.5	1174.8
120	45.9	66.6	2.58	81	1387.3	0.0	1387.3	0.34	41.0	1346.3
240	53.8	78.0	2.58	81	1623.8	0.0	1623.8	0.34	82.1	1541.7
360	59.1	85.7	2.58	81	1785.1	0.0	1785.1	0.34	123.1	1661.9
480	63.5	92.0	2.58	81	1917.0	0.0	1917.0	0.34	164.2	1752.9
600	67.2	97.5	2.58	81	2029.7	0.0	2029.7	0.34	205.2	1824.5
720	70.5	102.2	2.58	81	2128.7	0.0	2128.7	0.34	246.2	1882.5
840	73.4	106.5	2.58	81	2217.8	0.0	2217.8	0.34	287.3	1930.5
1440	84.9	123.0	2.58	81	2562.4	0.0	2562.4	0.34	492.5	2069.9
2160	93.7	135.8	2.58	81	2829.0	0.0	2829.0	0.34	738.7	2090.3
2880	100.0	145.0	2.58	81	3019.0	0.0	3019.0	0.34	985.0	2034.0
3000	100.8	146.2	2.58	81	3045.3	0.0	3045.3	0.34	1026.0	2019.3
3300	102.9	149.1	2.58	81	3106.3	0.0	3106.3	0.34	1128.6	1977.7
3600	104.7	151.9	2.58	81	3163.1	0.0	3163.1	0.34	1231.2	1931.9
3900	106.5	154.4	2.58	81	3215.6	0.0	3215.6	0.34	1333.8	1881.8
4200	108.1	156.8	2.58	81	3264.8	0.0	3264.8	0.34	1436.4	1828.4
4500	109.7	159.0	2.58	81	3311.6	0.0	3311.6	0.34	1539.0	1772.6
4800	111.1	161.1	2.58	81	3355.7	0.0	3355.7	0.34	1641.6	1714.1

Figure 9 - 1 in 100 year + 45% CC attenuation volumes to 2.8 l/s

A hydraulic model has not been developed to simulate the flows within and flooding from the piped drainage network. It is not possible to simulate the pitch drainage within the hydraulic modelling software to accurately simulate the flow within a perforated pipe network which uses the pitch sub-base as attenuation and storage, as is the case with this particular drainage network.

The design of the pitch sub-base and the associated drainage network is such that additional surface water flows that cannot be accommodated within the piped drainage network will enter the pitch sub-base via the perforated pipe network, and will be attenuated in the sub-base until such a time and the flows within the piped network have subsided to a level which will allow the surface water to re-enter the piped network and discharge downstream into the drainage ditch.

As such, in the case of surface water networks for pitches, which use the sub-base as a storage area, it is accepted that confirming that there is adequate storage within the pitch to accommodate any flooding, is an acceptable work-around for the shortfall.

Further information on the design and attenuation volumes within such events can be seen within:

- G-229824 10 – Proposed AGP Drainage Layout
- G-229824 11 – Proposed AGP Drainage Strategy

Foul Water Drainage Strategy

There will be **no foul water** produced as part of the site development.

Surface Drainage Maintenance

The drainage system will be designed to minimise maintenance requirements; however, a full maintenance scheme will be established for those elements not being offered for adoption.

Maintenance operations will be carried out by Leisure United in perpetuity post development and the Drainage Management & Maintenance is outlined within the below section.

Construction Surface Water Management

The existing surface is permeable, and the principal of the sports pitch uses the pitch sub-base as attenuation and storage.

Due to the nature of the construction works, little onsite material storage is required. During the processes when it is required it will be for relatively short periods of time.

Below is a brief description of the key construction works for an Artificial Grass Pitch and associated activities:

- Topsoil strip and a cut and fill undertaken across the site.
- Installation of the new drainage system, with the process taking approximately 3 days to complete. The materials largely involve the delivery of pea shingle material stockpiled within the development footprint with 80mm and 150mm Ø UPVC perforated corrugated plastic carrier drainage pipes to EN1401-1:1998 laid into geotextile lined, gravel-filled trenches. The UPVC perforated corrugated plastic carrier pipes shall be stored onsite within the designated fenced and enclosed storage areas prior to being securely laid and covered within the ground.
- The boundary of the development shall be lined with PCC kerb edging detail and the necessary fence posts, floodlighting foundations that involves concrete foundations. These materials will be stored within the designated storage area in bulk delivery with each being heavily weighted with minimal risk of movement.
- Following the PCC kerb installation, the crushed stone is installed and rolled to form the sub-base to the development.
- At this stage the fencing system shall be erected and in place around the development footprint and any/all materials within the development will be safely secured.
- The development area shall then be surfaced with tarmacadam on top of the stone sub-base. The process of tarmac surfacing requires material to be delivered and laid at set temperatures and therefore no materials will be storage onsite for this process and works and shall take approximately 5 days to complete.
- Upon completion of the base works the artificial surfacing shall be delivered in bulk to the pitch base within the secure fenced area. The material is rolled out and laid with the boundary of the surfacing being clamped and secured to the edging detail so that the material stays insitu and cannot be removed during any flood event or otherwise.

The development location itself acts as a sediment trap / barrier that retains surface water within the site boundary with any/all surface water run off going through the existing infrastructure of the hard-standing surfacing, stone foundation, geotextile membrane and entering into the existing and proposed drainage network that is lined with a geotextile membrane, pea shingle and drainage channels that each connect to a silt trap inspection chamber. This process will adequately trap and retain sediment throughout the construction process.

The existing and proposed levels and gradients of the site lead across the sports pitch. Whilst travelling across the development through the natural fall of levels the surface water will infiltrate through the stone foundation, geotextile membrane and entering into the existing and proposed drainage network that is lined with a geotextile membrane, shingle and drainage channels that each connect to a silt trap inspection chamber. This process will adequately trap and retain sediment throughout the construction process. Any run off that travels through the site prior to naturally infiltrating through the base would be retained within the development boundary. Surface water would sit within the development area until it naturally infiltrates through the existing hard-standing surfacing, stone foundation, geotextile membrane and entering into the existing and proposed drainage network that is lined with a geotextile membrane, shingle and drainage channels that each connect to a silt trap inspection chamber.

Throughout the development works the areas and development footprint will be cleared, cleaned and jet washed with the silt traps collecting all sediment and being emptied as / when required until all construction works are completed.

Run-off rates from the site will be managed so they are no greater than pre-development or in keeping with the best practice guidance to minimise risk of blockage.

Run-off control will include provision of appropriate levels / grading to direct any water from the construction site to remain on site.

Site Drainage Proposals Conclusions

- The proposed development includes the creation of a new external artificial grass pitch with perimeter ball-stop fencing, and clean accesses.
- The proposed development area will occupy land and replace an existing sports area.
- Surface water is to be disposed of into a watercourse;
- Adequate attenuation within pitch base and upper surface (comprising a permeable granular sub-base) to ensure that excess volumes, which would be experienced during a critical storm event, does not bypass the control system.
- This drainage strategy is designed to ensure no above ground flooding occurs up to and including the 1 in 100 year event + 45% allowance for climate change.
- The surface water drainage from this site, post development, is such that the surface water will be managed and disposed of within the site boundary, thus complying with the Planning Practice Guidance for 'Flood Risk and Climate Change' to the National Planning Policy Framework.
- Based on the above and providing the above strategies are adopted; the developed site will not contribute further to flood risk thus satisfying the principles of the National Planning Policy Framework.

Drainage Management & Maintenance

Gullies, Pipework, Inspection Chambers and Controls	
Required Action	Frequency
Regular Maintenance	
Remove cover and inspect chambers and pipework ensuring water is flowing freely and that the exit route for water is unobstructed.	Annually
Undertake inspection after leaf fall in autumn, remove leaves from gullies, chambers and pipes.	Every autumn
Inspect silt traps and clear of silt	Every 6 months or as required
Inspect catchpits and clear of silt	Every 6 months or as required
Remedial work	
Remove debris, silt and leaves from inspection chambers and flow control chambers.	As required
Remove debris and silt from pipework through high pressure jet washing.	As required
Repair physical damage if necessary.	As required
Monitoring	
CCTV survey to establish condition of pipe runs. Cleansing or repair of physical damage to be conducted if necessary	Every 5 years or as required

Permeable and Porous Surfaces	
Required Action	Frequency
Regular Maintenance	
Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional Tasks	
Stabilise and mow contributing and adjacent areas	As required
Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required and in accordance with manufacturer's recommendations
Remedial Work	
Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost material.	As required
Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
If efficiency of water percolating to the sub-base drops, jet washing and suction cleaning could substantially reinstate paving to 90% efficiency (as per recent experience).	As required
Monitoring	

Initial inspection	Monthly for three months after installation
Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48h after large storms in first six months
Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
Monitor inspection chambers	Annually